CLAIMS

1. Fish based food product comprising two materials, a paste material and a fibrous material, the paste material being aerated by texturization, incorporating individual fibres or bundles of fibres with a diameter in the range of 1 µm to 1 mm, the product presenting a heterogeneous texture and a firm and elastic overall consistency similar to that of fish or crustacean muscle tissue, characterised in that the fibrous material, obtained by extrusion cooking, forms a network of macroscopic fibres whose diameters are in the order of 0.1 mm to 1 mm, ramified into microscopic fibres with diameters in the order of 1 µm to 0.1 mm.

2. Fish based food product comprising two materials, a paste material and a fibrous material, the paste material being aerated by texturization, incorporating individual fibres or bundles of fibres with a diameter in the range of 1 µm to 1 mm, the product presenting a heterogeneous texture and a firm and elastic overall consistency similar to that of fish or crustacean muscle tissue, characterised in that the fibrous material consists of small fibres with a diameter of 0.1 mm to 1 mm, obtained by size reduction of a fish based preparation, or originating from natural fibres of marine products resulting from mechanical separation of myotomes.

3. Product according to claim 1 characterised in that it contains over 30% of fish meat, in particular between 30 and 60%, and 25 to 40% water, in two- or three-dimensional shapes such as thin strips, cylinders, fish pâtés or other shapes, to which colouring is added in some cases.

4. Product according to claim 3 characterised in that the shapes are typically 1 to 12 cm in length and weigh between 3 and 300 g, typically 3 to 20 g.

5. Fish based food product incorporating a product according to claim 1, the paste material consisting of over 30% of fish meat, the preparation being in the form of fish steaks, fish and vegetable based cakes, filled bars, quiches, pies, thin slices, spreads, fish rillettes, fish pâté, small ludic shapes.

6. Process for the production of a product with a heterogeneous texture according to claim 1 characterised in that it is comprised of the following steps :

- manufacture of fibrous material and paste material;

- mixing the fibrous material with the paste material;

moulding the mixture to form shapes.

7. Process according to claim 6 characterised in that paste material is textured, usually by addition of air, using homogenisation, emulsification and/or expansion and/or cutting type processes before mixing with the fibrous material, at a rate of 0.5 part to 1 part air per 1 part of paste material, in order to obtain a gelling strength in the order of 50 to 150 g/ cm^2, or after mixing with the fibrous material by adding between 0.3 and 1 part air per mixture part.

8. Process according to claim 6 characterised in that the fibrous material consists of a ramified network of fibres obtained from minced fish meat by means of a high-temperature and high-moisture extrusion cooking process comprised of the following steps :

a. introduction of fish meat into a single screw extruder;

b. transfer of fish meat from one end to the other of the extruder barrel, adjusting screw configuration and temperature within the barrel such that raw materials successively undergo a mixing and heating step up to a temperature of about 130°C, followed by a melting step with an increase in temperature of the material to above 130°C, generally between 140°C and 200°C, and an increase in pressure to between 0 and 50 bars, such that plasticization of the transferred material takes place;

c. extrusion at the far end of the barrel of the material obtained after plasticization through a die adapted for texturization, shaping and cooling the material such that a product with a ramified fibrous structure is obtained.

9. Process according to claim 8 characterised in that the extruded material is cooled in the die to a temperature of 100°C, possibly even between 80°C and 30°C, and comprises an initial cooling phase in an uncooled zone in the die at the outlet of the barrel, followed by a second cooling phase in a cooled zone of the die.

10. Process according to claim 8 characterised in that the fibrous material obtained at the die outlet is cooled in a cold shower, sliced to the desired length, then ground, with bundles of extruded fibres being cut and separated by shredding, mincing, lamination, blending, homogenisation and separation such that they can be dispersed in a fish based matrix.

11. Process according to claim 8 characterised in that the extruded mixture contains 15 to 50% of dry matter, notably 25 to 40%, the dry matter consisting of at least 35% of total proteins.

12. Process according to claim 11 characterised in that 25 to 100% of dry matter in the extruded mixture consists of dry matter originating from fish and/or other marine products, essentially comprised of marine proteins in the form of minces, fillets, pulps, surimi extracts, etc. and, in some cases, other marine extracts such as fish oil, fish bone powder, crustacean shell powder, chitosane, fish collagen.

13. Process according to claim 12 characterised in that, in addition to dry matter originating from fish, the dry matter in the extruded mixture contains functional milk proteins, such as whey proteins, caseins and/or caseinates, the functional milk proteins being in a dried or concentrated form.

14. Process according to claim 12 characterised in that the extruded mixture also contains egg proteins in liquid or powder form, vegetable or dairy fats, concentrated or isolated vegetable proteins, vegetable flour, starches and other complex carbohydrates, food grade hydrocolloids, spices, flavouring and colouring.

15. Process according to claim 8 characterised in that extruded fibres are used in fresh form or preserved by physical treatment such as freezing, pasteurisation or sterilisation.

16. Process according to claim 7 characterised in that the fibrous material consists of small fibres obtained from a fish based preparation according to the following steps :

- mixing the ingredients of the fish based preparation;
- forming the fish based preparation;
- moulding and cooking the fish based preparation to allow gelling to take place;
- cooling;
- size reduction of the cooked fish based preparation such as cutting or grating.

17. Process according to claim 16 characterised in that fish based preparation used in the manufacture of small fibres consists of over 50% washed and refined fish meat suitable for gelling, to which cryoprotectant type stabilising agents are added for freezing purposes, and

a moisture content below 80%, the fish based preparation possibly enriched with gelling or thickening agents so as to obtain a gel strength of 150 to 300 g/cm^2.

18. Process according to claim 7 characterised in that the fibrous material contains cooked or raw natural fibres from crab or other marine products, obtained by mechanical separation treatment, usually using a mixer with a rotary cylinder and comb.

19. Process according to claim 7 characterised in that the paste material :

- contains over 30% washed and refined fish meat suitable for gelling, to which cryoprotectant type stabilising agents are added for freezing purposes, and a moisture content below 80%;

- and in some cases enriched with gelling or thickening agents so as to obtain a gel strength of 100 to 250 g/cm^2 prior to texturization.

20. Process according to claim 7 characterised in that the level of incorporation of fibrous materials in the paste material is between 5 and 60% in weight, depending on the desired final texture, usually between 5 and 30%.

21. Process according to claim 7 characterised in that mixing takes place at a temperature in the range of -10°C and +20°C.

22. Process according to claim 7 characterised in that the fibrous material mixed with the paste material consists of at least one type of fibre chosen from the group comprised of ramified network fibres, fine fibres and natural fibres.

23. Process according to claim 7 characterised in that the fibres can be the same colour as the paste material or a different colour.

24. Process according to claim 7 characterised in that fibres are incorporated according to a statistical method, in a blender or mixing tank, or according to a dynamic method, notably in an on-line mixer

25. Process according to claim 7 characterised in that melting of the textured paste material is regulated as a function of the level of fats between 0 and 50%.

26. Process according to claim 7 characterised in that the paste obtained by mixing the fibres and paste material undergoes the following steps :

- forming by extrusion or moulding into two- or three-dimensional shapes or into a strip;

- cooking, leading to gelling and stabilisation of the product;

- cooling.

27. Process according to claim 26 characterised in that surface colour may or may not be added to the forms obtained, either to raw forms and/or after the cooking step by spraying, depositing colour on the strip or extrusion of a coloured paste material.

28. Process according to 26 characterised in that the cooking step consists of a combination of a microwave cooking step and steam cooking step, microwave cooking essentially providing rapid cooking to the core of the product so as to produce a sufficiently stable gel-like structure that is stable before cooling while steam cooking leads to the surface of the product being cooked without drying it out, with microwave cooking being carried out before or simultaneously to steam cooking.

29. Manufacturing installation according to claim 6 characterised in that is comprised of means for the manufacture of fibrous material, means for the manufacture of paste material, forming, cooking, colouring and mixing means.

30. Manufacturing installation according to claim 29 for application of the process where the means for manufacture of fibrous material consist of a screw extruder (1) with two very similar interlocking screws which rotate in the same direction or in the opposite direction inside a horizontal barrel, a filling device attached at the near end (2) of the barrel, fitted with at least one metering device for metered flow of the mixture at a predetermined rate, an extrusion die (7) located at the far end (6) of said barrel, thermal treatment assembly (8a) for fine-tuning the temperature within the barrel and extrusion die, said barrel being comprised of :

- a first zone (9) for supply of the product formula;

- a second zone (10) for mixing, moisturisation where this is required, and heating the material up to a core temperature of at least 130°C;

- at least a third zone (11) for melting, increasing the temperature of the material to over 130°C, generally between 140 and 200°C and pressure of the material to between 0 and 50 bars, depending on the composition of the formula, in which protein plasticization takes place, especially of fish proteins.

31. Installation according to claim 30 characterised in that the second mixing and heating zone (10) includes 2 to 5 units, the third melting zone (11) includes 1 to 3 units, with a screw length to screw diameter ratio of about 10 to 33, typically between 25 and 33.

32. Installation according to claim 30 characterised in that the extrusion die includes a first uncooled zone (15) adjacent to the near end of the screw extruder, followed by at least one cooling zone (16), respectively corresponding to an alignment zone of the melted and plasticized material in the viscous state and a change-of-phase zone from the viscous to solid state.

33. Installation according to claim 30 characterised in that the die (7) is connected to the barrel (2) by means of at least one, and typically two, adapters, the first adapter including one or two perforations through which the melted and plasticized material is extruded, the second adapter being located between the first adapter and the extrusion die, intended to balance materiel pressure and flow rate.

34. Installation according to claim 30 characterised in that the extrusion die has an internal shape that is adapted to the final product, with its size parameters designed to allow cooling of the melted and plasticized material to 100°C, possibly between 80 and 10°C, its inner surface having a controlled roughness in order to exert shear forces on the product during the cooling process, the combination of cooling and shear forces leading to continuous texturization of the cooled material to form fibres.